

Measuring Treasury Debt and Market Depth

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- US fiscal debt has come back into sharp focus recently
 - COVID-19
 - Industrial policy
 - Inflation
 - Rising interest rates
- Traditional view of the UST market focuses on size, not depth

- **Contributions**

- ① Simple sum of USTs is incorrect
- ② Derivation of user cost of USTs
- ③ Creation of index to track true aggregate
- ④ Value of USTs directly impacts fiscal sustainability

USTs are Imperfect Substitutes

Literature

- Krishnamurthy and Vissing-Jorgensen (2012, 2013)
- Nagel (2016)
- :
- All: the various maturities/types of UTSs have different attributes/purposes

Findings

- Extension of Amihud and Mendelson (1991)
 - Match securities that mature within one day of each other
 - Regress YTM spreads against a variety of factors
- **Contribution**
 - Bills are a liquidity hedge
 - Bonds are a savings vehicle
 - They should not be linearly aggregated

Details

The User Cost of Treasury Securities

- A proper index number
 - Not the aggregate, itself
 - Tracks the aggregate nonparametrically
 - Must be derived from optimization

- Standard single-period user cost

$$\eta_t = \frac{R_t - r_t}{1 + R_t}$$

- Barnett (1978)
- Opportunity cost of holding the asset

- Partial equilibrium model: household
 - Standard utility maximization
 - Short- and long-term bonds, and a benchmark asset

- **Contribution**

- Deriving the single-period user cost of a long-term asset

Details

The User Cost of Long-Term Treasury Securities

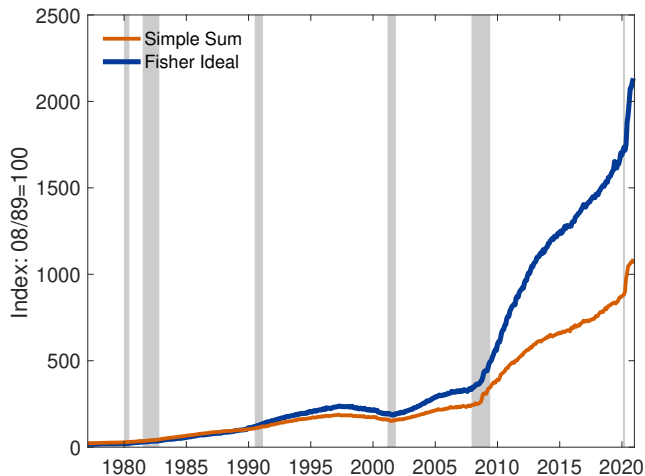
$$\eta_t^L = \frac{\mathbb{E}_t \left[\frac{\mu_{t+1}}{\mu_t} \frac{1}{\pi_{t+1}} \left\{ \overset{\text{one-period return, benchmark}}{\downarrow} R_t^n - (1 - \delta) \gamma_{3,t+1} \Delta R_{t+1}^n - \left(\overset{\text{long-term bond}}{\downarrow} r_t^{L,n} - (1 - \alpha) \gamma_{4,t+1} \Delta r_{t+1}^{L,n} \right) \right\} \right]}{\mathbb{E}_t \left[\frac{\mu_{t+1}}{\mu_t} \frac{1}{\pi_{t+1}} \left\{ 1 + R_t^n - (1 - \delta) \gamma_{3,t+1} \Delta R_{t+1}^n \right\} \right]}$$

- $R_t^n, r_t^{L,n}$ are “coupon” rates
 - $\gamma_{i,t+1}$ is the expected price
 - $\delta, \alpha \in (0, 1]$ are the maturity rates
- $\left. \begin{array}{l} \text{ } \end{array} \right\} \gamma_{3,t+1} \Delta R_{t+1}^n$ is the expected capital gain

Data and Baseline Result

- Center for Research in Securities Pricing (CRSP)
- CUSIP-level, monthly data on US Treasuries: 1977-2020
- 1-month ahead forward rates used for expected values
- Fisher-ideal index functional form
 - Securities separated by type
 - Then separated by quarters to maturity

Initial Results

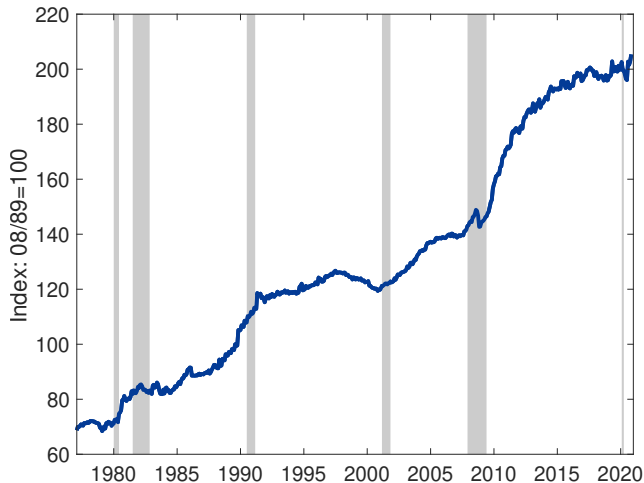


Extracting the Monetary Services of Treasury Securities

$\% \Delta(\text{Quantity} + \text{Monetary Services})$

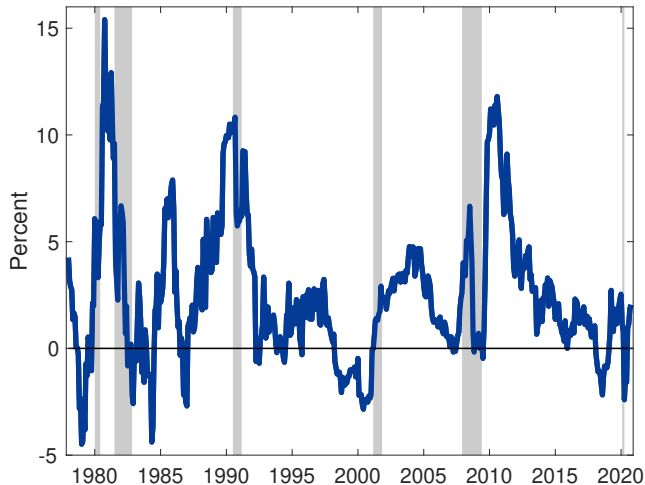
$-\% \Delta(\text{Quantity})$

$= \% \Delta(\text{Monetary Services})$



It's all Relative

- This index is a measure of the “depth” of the market
- More recent movements align with
 - Budget surpluses of the 1990s
 - European debt crisis of the 2010s
 - COVID-19 “dash for cash”



The Value of Treasury Securities

- Traditional accounting of fiscal capacity relies on the simple sum of USTs
- The analysis here shows that this is incorrect
- USTs provide a monetary service to the economy
- Brunnermeier, Merkel and Sannikov (2022)-like analysis
- **Contribution**
 - The value of USTs directly contributes to fiscal sustainability
 - Also see the tradeoffs faced when considering a portfolio of USTs with varying maturities

Fiscal Capacity and the Value of USTs

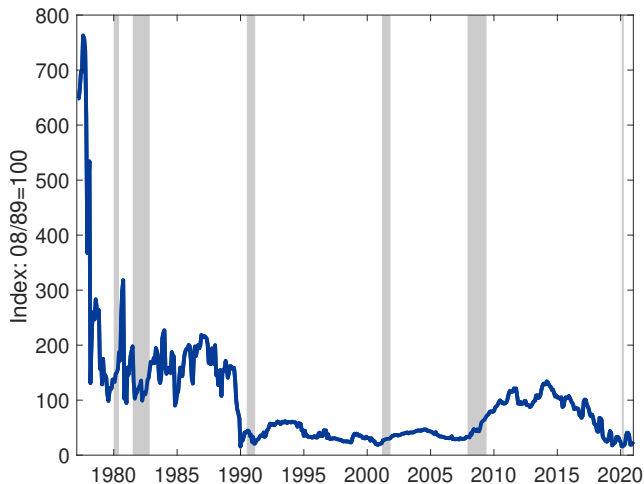
$$\begin{aligned}
 \frac{B_{t-1} + B_{t-1}^L}{p_t}(1 + r_{t-1}) = & \underbrace{s_t}_{\text{Primary surplus}} - \underbrace{(r_{t-1}^L - r_{t-1}) \frac{B_{t-1}^L}{p_t}}_{\text{Spread Component}} + \beta \mathbb{E}_t \left[\frac{\mu_{1,t+1}}{\mu_{1,t}} \frac{B_t + B_t^L}{p_{t+1}} (1 + r_t) \right] \\
 & + \beta \mathbb{E}_t \left[\frac{\mu_{1,t+1}}{\mu_{1,t}} \frac{B_t^L}{p_{t+1}} (1 + r_t^L - (1 - \alpha) \gamma_{4,t+1} \Delta r_{t+1}^{L,n} - r_t) \right] + \gamma_{2,t} \frac{M_t}{p_t}
 \end{aligned}$$

↑
Relative Holding-Period Return
↑
Value of Monetary Services

- M_t is stock of monetary services
- $\gamma_{2,t}$ is the price dual of those monetary services
- Thus, the value of these monetary services directly adds to fiscal capacity

The Value of these Monetary Services

- Price dual via Fisher's factor reversal
- Further exploration of this is needed
 - Fiscal sustainability
 - Inflation
 - Monetary policy



• Contributions

- ① Simple sum of USTs is incorrect
 - ② Derivation of user cost of USTs
 - ③ Creation of index to track true aggregate
 - ④ Value of USTs directly impacts fiscal sustainability
- USTs are more than just the sum of their principal value

• Extensions

- Applications to sovereign debt crises
- Expansion of the measure to include risk
- Refining the basket of securities
- Monetary-Fiscal interaction and inflation

Thank You!

Questions?

Appendix Slides

Bond Market Segmentation: Model

- Data

- USTs: separated by nominal type
- Oct 1996–Dec 2020 subsample

- Methodology

- Matching by days to maturity
- Bill matches: 6 months maturity or less
- Dependent variable: YTM spread

spread: “senior” – “junior”

- Independent Variables

- 1 Relative bid-ask spread

$$\frac{\text{ask price} - \text{bid price}}{\text{ask price} + \text{accrued interest}} \times 100.$$

- 2 Coupon rate spread
- 3 Months/years to maturity
- 4 10y-2y spread
- 5 Constant

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	Notes–Bills	Bonds–Notes	Bonds–Bills
Relative Bid-Ask Spread	0.4163** (0.173)	0.0981 (0.074)	−0.1424** (0.074)
Coupon Rate Spread	0.0210*** (0.001)	0.0170*** (0.005)	0.0076 (0.013)
10y-2y Spread	0.0234*** (0.003)	−0.0124*** (0.002)	−0.0484 (0.033)
⋮	⋮	⋮	⋮
Observations	2250	7430	78
R-Squared	0.207	0.505	0.399
F-statistic	99.48	207.2	20.19

Bonds in the Utility Function

- Analysis of USTs is relative to USTs only
 - Bonds are still liquid overall
 - Bills are still safe overall
 - Modeling this way avoids larger assumptions
- Simple frictions to capture liquidity, etc. can be represented in a money-in-the-utility setting
- Use of $MB = MC$
 - Left side: parametarized assumptions
 - Right side: equivalent, nonparametric form

$$\max \mathbb{E}_t \sum_{t=0}^{\infty} \beta^t \{u(c_t) + v(m_t) + x(1 - l_t)\}$$

- m_t : monetary services \sim second-order translog function
 - 1 an exact aggregator function
 - 2 second-order Taylor approximation of unknown aggregator
 - 3 second-order approximation to a CES function

(Boisvert, 1982)

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Initial, Monthly Results

